

Power-Thrifty PCs

BILLION-DOLLAR SAVINGS WITH BETTER POWER SUPPLIES BY STEVEN ASHLEY

Putting a personal computer to sleep is typically the only means for users to conserve electricity, besides frequent, often inconvenient, shutdowns. Now a new focus of energy savings for the PC has emerged—its power supply.

When a PC is operating, its power supply typically converts only 60 to 70 percent of the 120-volt AC power into the 12-, 5- and 3.3-volt DC juice the internal system components need. The rest is mostly lost to heat. Each of the estimated 205 million PCs in the U.S. consumes an average of about 300 kilowatt-

users to implement," many of whom do not bother to do so. Moreover, often home computer and entertainment systems are networked and must stay on to be fully functional, which makes sleep-mode management difficult. Instead, Hershberg continues, "we're aiming at making the PC power supply more efficient—a target that doesn't require the user to do anything special."

Today's PCs use switching-mode power supplies (SMPS), says Michael Archer, chief technology officer at EOS, a division of Celetronix USA in Simi Valley, Calif. SMPS rely on a fast-acting switch to chop up the current, which is ultimately converted into low-voltage DC signals. Standard, "forced commutation" SMPS rely on a process "in which the current is made to turn on and off when it doesn't want to," Archer explains; in contrast, higher-efficiency "resonance-based" SMPS "only control the movement of that energy and so produce fewer losses." They can better match the demand for power with the supply and so produce less wasted energy.

In recent benchmark tests, the supplies that were 80 percent efficient cut energy use 15 to 25 percent across the board, reports Chris Calwell, director of policy and research for Ecos Consulting, a Portland, Ore.-based firm that promotes energy-efficient products. "Such improved units would cost about \$5 more apiece wholesale but over four years of use would save about \$25 in electricity costs." Ecos has formed partnerships with utilities to offer financial incentives to PC makers that install efficient power supplies.

Energy shavers are also targeting power-hungry central processing units (CPUs) and graphics cards. Intel and other chip-makers, for example, are now selling CPUs designed for laptops to desktop PC manufacturers. Laptop CPUs, designed to maximize battery life, can slow their processing speeds, thereby drawing less voltage. And engineers are looking for ways to improve the efficiency of the newest



SLEEP MODE conserves energy, but better AC-to-DC conversion can save a lot more.

hours of power annually, and that figure does not include the monitor's energy usage. Making PC power supplies 80 percent efficient, researchers say, could shave U.S. energy use by 1 to 2 percent and pare \$1 billion or more from the nation's yearly electric bills while cutting emissions from generating plants significantly.

That is the goal of new energy-saving efforts being undertaken by federal and state agencies, environmental groups, electric utilities and the computer industry. "In the past," says Craig W. Hershberg, a product development manager in the U.S. Environmental Protection Agency's Energy Star program, "we promoted greater use of instantly available 'sleep modes' to save PC energy use, but we've found that approach to be less than totally satisfactory, because it relies on the



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video cards, which may draw 50 to 60 watts each—as much as an entire computer.

Ecos and environmental watchdog Natural Resources Defense Council, working with Intel and others, have joined with the California Energy Commission and the EPA to launch a global competition to identify innovative design concepts that could boost efficiency (see

www.efficientpowersupplies.org). Researchers at Ecos meanwhile are developing performance metrics by which PCs can be assessed in the same way that miles per gallon measures automotive fuel usage—with a benchmark score divided by the system's electrical consumption. This metric could serve as the basis for new PC energy efficiency ratings.

ENTOMOLOGY

The 17-Year Itch

BROOD X REAPPEARS, WITH CLUES TO CICADA BEHAVIOR BY TABITHA M. POWLEDGE

NOISY OPPORTUNITY

Investigating cicada life cycles is especially challenging because the insects are around for only a few weeks before dying and cannot be raised artificially. So researchers are glad to get e-mail and phone messages about emergences from amateur enthusiasts such as John Zyla in southern Maryland. Zyla, a military contractor, has turned himself into a respected cicada-brood mapper in the mid-Atlantic. "I don't have any special training," says Zyla, who works with the University of Connecticut cicada researchers. He has learned cicada songs, and such noisy creatures are easy to find. "People can make a big contribution," he declares, "by mapping [the insects'] distribution whenever the next brood comes out in their area. Chances are, no one else ever has."

University of Connecticut
"Cicada Central":
<http://collections2.eeb.uconn.edu/collections/cicadacentral/index.html>

College of Mount St. Joseph
cicada Web page:
www.msjs.edu/cicada/

From late May through June, Brood X of the periodical cicadas will emerge from the ground, having spent the past 17 years as nymphs feeding off tree roots. After digging their way out and molting into adults, billions of the big, clumsy, red-eyed insects will sing their earsplitting love songs. Last seen in 1987, the brood will provide a prodigious if brief feast for birds, along with an incomparable opportunity for researchers. Fascinated naturalists have been writing about periodical cicadas for four centuries. But much remains unknown about the insects' periods or what triggers their synchronized appearances.

Brood X is perhaps the largest and best studied of the approximately 15 broods of periodical cicadas (researchers dispute the exact number). A brood emerges somewhere east of the Great Plains almost every spring. Worldwide, investigators have identified some 3,000 cicada species but know the life cycle for only a dozen or so. William Bradford, governor of the Plymouth Colony, first described periodical cicadas in 1633, although Native Americans probably knew of the creatures before then. The 17-year life cycle was firmly established less than a century later; by the mid-19th century, naturalists had recognized 13-year cicadas.

For more than 100 years, entranced mathematicians and biologists have tried to explain why periodical cicadas have evolved these prime-number cycles. One idea has been that the different cycles reduce competition for resources and interbreeding, because 13- and 17-year broods in the same locale will emerge

together only once every 221 years. But in fact, different periodical cicada broods tend to be dispersed; little geographic overlap exists among most of them. And they do almost all their competitive eating during their long underground years, when they are sucking sap from tree roots.

Theorists have also argued that these oddball life cycles help cicadas to avoid predators and parasites with shorter, even-numbered life cycles. In 2001 researchers at the Max Planck Institute of Molecular Physiology in Dortmund, Germany, reported that prime-numbered life cycles emerged from their mathematical model of predator-prey relations.

Cicada researchers are deeply dubious about this explanation, however. The theory has not been falsified, notes evolutionary biologist Chris M. Simon of the University of Connecticut, because it cannot be tested. Her colleague David C. Marshall points out that true periodicity is rare in cicadas—separate groups of most species emerge every year. "If periodical cicadas evolved longer and longer life cycles to avoid a synchronizing parasitoid species," he notes, "then why has this apparently not happened in scores and scores of other cicada species that suffer predation and parasitism, not to mention in other kinds of insects and other animals?"

More curious to biologists such as Simon is the interaction among broods. As it does every spring, the University of Connecticut team will map cicada distributions, collect the insects for genetic analysis, and conduct small experiments on mating behavior. This year, Simon says, the researchers will scoop up